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DEVELOPMENT OF A SELF-REPORT MEASURE OF METACOGNITION: THE METACOGNITION SELF-ASSESSMENT SCALE (MSAS). INSTRUMENT DESCRIPTION AND FACTOR STRUCTURE

Roberto Pedone, Antonio Semerari, Ilaria Riccardi, Michele Procacci, Giuseppe Nicolò, Antonino Carcione

Abstract

Objective: Metacognition is a multi-component psychological construct, characterized by the ability to identify and describe one's own mental states and those of others. Evidence has been found for an association between impairments in metacognitive abilities and poor social functioning, low quality of life, severity of psychopathology in Personality Disorders (PDs). However, to date, there are few psychometrically validated instruments available for assessing the different components of metacognition. A self-report questionnaire, the Metacognition Self-Assessment Scale (MSAS), has been developed to evaluate the different functions of metacognition (Monitoring, Integration, Differentiation and Decentration) as defined in the framework of Metacognitive Multi-Function Model (Semerari et al. 2003, 2007). The aim of the present study is to preliminarily investigate the psychometric properties of the MSAS in a large non-clinical sample.

Method: The MSAS was administered to 6659 people randomly recruited from the general population. Exploratory and confirmatory factor analyses were carried out to examine the dimensionality of the MSAS.

Results: The results of the exploratory and confirmatory factor analyses revealed a good fit for a four-factor model of metacognition and suggested that metacognition as measured by the MSAS is a multidimensional construct consisting of one general factor with several sub-components. All Monitoring and Integration items loaded on the first factor which appeared to correspond to self-directed reflective cognition, that we named Self-Reflectivity. The Differentiation and Decentration items loaded on the second factor that captures the ability to distance oneself from cognitions and evaluate them critically, we named it Critical Distance. Items related to Monitoring Others' cognitions constituted a separated factor, related to the ability to understand others' minds, we named this factor Understanding Other Minds. The results also supported the hyp othesis that metacognitive regulation (i.e. Mastery) constitutes a separate metacognitive function, relatively independent of the metacognitive knowledge-related functions.

Conclusions: These preliminary results confirm that the MSAS has the premises to be validated as a reliable instrument for measuring metacognition and its components. In particular, the MSAS could represent a useful and flexible instrument for a rapid screening of metacognitive abilities in both clinical and non-clinical contexts.

Key words: metacognition, mentalization, mind-reading, assessment

Declaration of interest: the authors have nothing to disclose. This manuscript contains no actual or potential conflict of interest on the part of any of its authors.

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Introduction

In general and clinical psychology, a class of human mental activities, generally referred as "mind-reading" abilities, have been traditionally investigated by researchers from multiple theoretical backgrounds and research fields, each with its own lexicon and terms (Baron-Cohen 1995, Flavell 1976, Fonagy 1991, Frith and Frith 2006, Frith and Happé 1999). A primary set of such terms and related constructs are: theory of mind (Premack and Woodruff 1978, Baron-Cohen 1995, Frith and Frith 2006), mentalization (Allen et al. 2008, Bateman and Fonagy 2004, Bateman et al. 2013), and metacognition (Bo et al. 2014, Dimaggio et al. 2007, Dimaggio and Lysaker 2010, Gumley 2011, Semerari et al. 2003). In a broad definition, theory of mind (ToM) is the ability to attribute mental states, such as beliefs, desires and intents, to oneself and others and to understand that others have beliefs, desires, intentions, and perspectives that are different from one's own (Premack and Woodruff 1978). Mentalization or mentalizing is the implicit or explicit perception or interpretation of one's or others' actions as intentional, that is, mediated by mental states or mental processes (Fonagy 2002). Metacognition is a broad term that can be used, among others, to define the abilities to

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understand and reflect on one's own and others' mental states. All of these definitions are representative of different research frameworks that are in part specific and in part overlap each other. At present, all of them share, at least, two common objects that are, mental states and functions that operate on them. Regarding the research framework we adopted to investigate mind-reading abilities, we refer to a functional-focused perspective model - the Metacognitive Multi-Function Model (MMFM) - by which an important aspect of metacognition specifically refers to a set of skills intended as set of functions. Those mental functions allow people to identify mental states, reasoning about them, and ascribing them to themselves and others, in order to regulate one's own mental states and interpersonal relationships (Carcione et al. 1997, Semerari et al. 2003). Following its functional operationalization, the MMFM states a set of functions, which are necessary to a) identify mental states and ascribing them to oneself and others on the basis of facial expressions, somatic states, behaviour and actions; b) reflect on and reason about mental states; c) use information about mental states to make decisions, solve problems or psychological and interpersonal conflicts and cope with subjective suffering (Carcione et al. 2010). This definition highlights how the MMFM focuses primarily on the meta-cognitive operations - the metacognitive functions – in respect to the meta-representation that are the processed objects. From this point of view, the MMFM catches an aspect of metacognition that is different from Wells's one (Wells 2000, Wells and Matthews 1994, 1996) that primarily considers metacognition as a set of beliefs about one's own mental content that helps people to regulate their attentive processes and that, in some cases, could induce the maintenance of dysfunctional attentive processes such as worry and rumination. In particular, the Self Regulatory Executive Function theory, also called the SREF model and developed by Wells and Matthews (Wells and Matthews 1994, 1996), demonstrates how metacognitive factors – i.e. , beliefs about cognition, emotion, and behavior - can provoke and maintain various psychological disorders. Specifically, these metacognitions or content beliefs predispose individuals towards coping strategies that might be maladaptive, ultimately compromising their psychological wellbeing (Flavell 1976, Wells 2000, Wells and Purdon 1999).

The principal aspects of metacognition which the MMFM focuses on both overlap and differ from the definition of mentalization given by Bateman and Fonagy (2004). Although mentalization's definition focuses on thinking about thinking (Fonagy 1991), it is a multidimensional construct that can be considered as a four-intersecting-dimensions: automatic/controlled (i.e. implicit/explicit); internally/externally based; self/other oriented; and cognitive/affective process (Bateman et al. 2013). The MMFM definition partially overlaps mentalization because it focuses on explicit cognitive processes and on the self/other dimension but differs from it because, at its level of specification, it defines specific functional processes that operate on mental states. In the MMFM definition, this class of mind-reading processes are constituted by different sub-functions that can be selectively impaired at different levels of regulation abilities (Choi-Kain and Gunderson 2008; Dimaggio et al. 2008, Semerari et al. 2007). Currently, metacognition is considered crucial in several areas of psychopathology (Dimaggio and Lysaker 2010, Gumley 2011). An impaired understanding of one's own and others' mental contents and processes seem to interfere with the development of an integrated and stable self-representation and with the creation of positive and long lasting relationships (Dimaggio et al. 2007a, Jørgensen 2010). In people with schizophrenia, metacognitive deterioration is strongly associated with diminished social skills and with neuropsychological and executive functions deficits (Lysaker et al. 2008, 2011a, 2011b). Metacognitive impairments have been described in patients with personality disorders (PDs) (Semerari et al. 2005; Dimaggio et al. 2009; Carcione et al. 2011), and they have been hypothesized to play a crucial role in the genesis and maintenance of PDs (Bateman and Fonagy 2004, Dimaggio et al. 2007b, Dimaggio and Lysaker 2010). Researches focused on sample of specific categorical diagnosis of PD, describe specific metacognitive impairments in Borderline Personality Disorders (Semerari et al, 2005, 2015) and Avoidant Personality Disorder (Moroni et al. 2016) Poor metacognition has been globally linked with the global severity of the PDs (Semerari et al. 2014) and with a cold, distant and non-assertive personality style (Spitzer et al. 2005, Inslegers et al. 2012). In contrast, high metacognitive capacities have been associated with greater emotional regulation skills and a better capacity to create stable interpersonal relationships (Bender et al. 2011). Due to the clinical relevance of the metacognition construct, there is increasing awareness about the need for reliable assessment tools.

Assessment of reflective abilities is possible through a) discourse analysis, b) interviews, c) self-report and d) laboratory tasks; each of these methods has pros and cons. Self-report instruments are the most commonly used assessment methods (Paulhus and Vazire 2007), but they have the limit that a person is called to use the presumed compromised skill. On the other hand, discourse analysis and interviews are more valid, but they are more expensive in terms of time, training, and resources. Several authors (Roberts et al. 2006) agree that a multi-method approach to assessment of psychological constructs should be preferred as a way of controlling potential measurement artifacts and thus increasing the validity of findings.

The aim of the present study was to present the development and the factorial structure investigation of a new MMFM-based self-report instrument, the Metacognition Self-Assessment Scale (MSAS), which could be used as a preliminary and fast screening tool for the evaluation of metacognition.

Construct description

The MSAS was developed from the MMFM (Semerari et al. 2003) and it is directly derived from two already validated instruments based on the same model, the Metacognition Assessment Scale (MAS), a rating scale for assessing metacognition in psychotherapy transcripts (Carcione et al. 2008, 2010; Semerari et al. 2003) and the Metacognition Assessment Interview (MAI), a semi-structured clinical interview (Pellecchia et al. 2015, Semerari et al. 2012).

Both MAS and MAI demonstrated acceptable levels of factorial validity, inter-rater agreement, internal validity and test–retest stability (Carcione et al. 2008; Dimaggio et al. 2009a, 2009b; Lysaker et al. 2005, 2010b, 2011a, 2011b; Pellecchia et al. 2015; Semerari et al. 2003, 2012) and scores on the MAS were shown to be related to executive functions and treatment outcomes (Carcione et al. 2008; Lysaker et al. 2005, 2008; Semerari et al. 2005).We hypothesised that the MSAS would have a four-factor structure reflecting the principal metacognitive abilities defined in the

MMFM model as operationalized in the MAS and the MAI (Carcione et al. 2010, Semerari et al. 2003) and consistent with single case studies (Dimaggio et al. 2009a, 2009b; Semerari et al. 2003, 2005) and the validation of MAI (Pellecchia et al. 2015, Semerari et al. 2012).

The MSAS assesses how people are able to identify their own and others' mental states and coping with distress and interpersonal problems. The items are similar, in their content, to those of the MAS, theoretically based on the literature on mentalization and attachment theories (Allen et al. 2008, Fonagy 1991, Fonagy and Target 1997), theory of mind (Baron-Cohen et al. 1985, Premack and Woodruff 1978), metacognition (Wellman 1990; Wells 2000; Wells and Mattews 1994, 1996) and, more generally, meta-representation (Frith 1992, Frith and Frith 2006, Frith and Happé 1999, Sperber 2000). MSAS, such as MAS, is divided in three main sections with grouped items that refer to a) reflection on one's own mental states i.e. the Self domain (Understanding one's own Mind - UM) b) reflection on others' mental states i.e. the Other domain (Understanting Others' Mind - UOM and Decentration, Dec) and c) coping with psychological suffering and interpersonal problems (Mastery - M) (Carcione et al. 2010; Dimaggio et al. 2009b; Semerari et al. 2005, 2007).

Understanding One's Own Mind (UM) is composed of the following sub-functions: a) Monitoring is the ability to identify and define the components that make up an inner state in terms of thoughts, images, and emotions (Identification) and the variables related to them (Relating Variable). b) Differentiation is the ability to differentiate between different classes of representation (e.g. dreams, fantasies, beliefs) and between representations and reality, recognising their subjectivity. c) Integration is the ability to reflect on different mental states and give a complete and coherent description of their components, with their evolution over time. It also relates to the ability to form a coherent narrative.

Understanding Others' Minds (UOM) is composed of the sub-functions: a) Monitoring, that is the ability to recognise and define the emotions underlying others' behaviours, expressions and actions and make plausible inferences about their thoughts. b) Decentration. It captures one's ability to define others' mental states by forming hypotheses independent of (his or her) their own perspective, mental functioning or involvement in the relationship, recognising their subjectivity. *Mastery* (M) encompasses the use of psychological information to cope with problems of increasing levels of complexity; it relates to regulation and control activities.

Hypothesis

Following the MMFM indications and consistent with the results of the previous study on MAI and MAS, we hypothesised for the MSAS a four-factors structure. More specifically, 1) The first factor captures Monitoring and Integration; 2) the second factor captures Differentiation and Decentration. We consider that the ability to monitor one's own inner state is a prerequisite for integration of mental states; in other words, one might find an individual with good monitoring ability who nevertheless fails to integrate mental states, but, on the contrary, it is not supposed to find an individual capable of integrating mental states who cannot monitor (his or her) their mental states. We hypothesised a similar relationship between Differentiation and Decentration. In such case, we consider that it is not possible to have a decentred perspective on others' mental states if one is not able to recognise that one's own perspective on any view about each event is subjective and it is a representation rather than reality itself (i.e. Differentiation). 3) The third factor captures understanding others' minds dimension (UOM) and 4) a fourth factor captures regulation and control abilities (Mastery).

UOM and Decentration are not analogous dimensions (Dimaggio et al. 2009a, Semerari et al. 2003); in fact, for example, it is possible to fully understand the emotional states of a person but rigidly attribute them to the relationship he/she has with us. The UOM dimension encompasses the processes that ascribe mental states to others whereas Decentration captures the perspective – decentred or egocentric – from which UOM ability is exercised. We therefore expected that UOM and Decentration were represented by different factors.

Methods

Participants

Potential participants responded to an advertisement; they were screened and provided with information about the study, then invited to provide written informed consent in accordance with the 'Ethical Principles of Psychologists and Code of Conduct'. The MSAS was included in a battery of questionnaires as part of a larger-scale data survey collection project for numerous studies. For the purpose of this study was submitted a brief check-list interview to control for exclusion criteria. Individuals were excluded if they responded to have history of psychiatric diagnoses, history of psychiatric or psychological treatments, history of severe brain injury and history of substance-related disorders. None of the participants were taking psychotropic drugs, nor had they used them during the month preceding the study. A total of 7046 people were randomly recruited from the general population of Naples and its hinterland; 387 (5.5%) individuals were excluded from this study, therefore 6659 met the including criteria: 3049 men (45.8%) and 3610 women (54.2%) aged from 18 to 75 years (M = 38.61; SD = 13.97). Data were collected in two separate phases and thus there were two sub-samples (Sample 1: n = 3459; 1552 (44.9%) men and 1907 (55.1%) women; age M = 33.83 years; SD = 13.68; Sample 2: n = 3200; 1497 (46.8%) men and 1703 (53.2%) women; age M = 33.09 years; SD = 13.85). Both sub-samples were used in the analyses.

Measures

The Metacognition Self-Assessment Scale (MSAS)

The MSAS is an eighteen-item self-report measure specifically developed for the assessment of MMFM sub-functions. The MSAS is scored using a five-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = frequently, 5 = almost always), which yields a raw score range of 18 to 90. High scores on the MSAS indicate better self-evaluation of metacognitive abilities than low scores. The MSAS is designed to measure five abilities of metacognition: 1) monitoring; 2) differentiation; 3) integration; 4) decentration and 5) mastery. Scores from the five subscales are summed to give a total score that

represents the individual's overall level of metacognitive functioning. The five abilities are assessed as follows: a) Monitoring is evaluated with six items divided into two groups, depending on whether they relate to monitoring of Self (see section A of the scale in the Appendix) or Others (section B). (A.1): the ability to recognise one's own representations such as thoughts and beliefs (Identification; UM_MON_ID1); (A.2): the ability to recognise and verbalise one's own emotions (Identification; UM_MON_ID2); (A.3): the ability to establish relations among the separate components of a mental state (Relating Variables; UM_MON_RV); (B.1): the ability to recognise others' representations such as thoughts and beliefs (Identification; UOM_MON_ID1); (B.2): the ability to recognise and verbalise others' emotions (Identification; UOM_MON_ID2); (B.3): the ability to form ideas about what social or psychological factors generate to others' mental states (Relating Variables; UOM_MON_RV); b) Integration is assessed with two items, (A.6): the ability to describe the cognitive and emotional aspects of an agent's mental state and the temporal and social or interpersonal dynamics of change (UM_INT1); (A.7): the ability to merge multiple potentially implausible or incoherent mental scenarios into a fluent narrative (UM_INT2). c) Differentiation is evaluated with two items, (A.4): the awareness that representations are subjective and not a perfect reflection of reality (UM_DIF1) and (A.5): the ability to perceive that thoughts do not directly influence reality, e.g. understanding that thinking about a catastrophe does not cause it (UM_DIF2). Having the ability to Differentiate means that one is aware that a memory could be false, and it is not an omen for the future; that a goal will not realise simply because one has expressed it and one's predictions about the future are only one of many possible scenarios that may come to pass. d) Decentration (section C) is evaluated with three items. (C.1): the ability to infer relationships among the separate components of others' mental states and between their mental state and their behaviour (DEC1); (C.2): the ability to recognise, define and verbalise others' cognitive inner states (DEC2); (C.3) the ability to recognise, define and verbalise other's emotional inner state (DEC3). e) Mastery (section D) is assessed in terms of the strategies which individuals use to exploit their knowledge of themselves and of others to solve psychological and interpersonal problems. These strategies are divided into categories according to the complexity of the metacognitive operations involved. In ascending order of complexity these are (D.1): dealing with a problem by voluntarily changing one's own behaviour (M1); (D.2): dealing with the problem through the regulation and management of one's mental states, e.g. distracting oneself from ideas and emotions causing suffering (M2); (D.3): drawing on one's beliefs, evaluations or general knowledge of one's own mental functioning to deal with the problem operating on underpinning (M3); (D.4) using one's own knowledge of other people's mental functioning to manage the interpersonal dimension of a problem (M5); (D.5) Mature acceptance of the limits to one's capacity to change one's inner states and influence events (M5). The MSAS item scale was developed following the MMFM model implementation mentioned above. The first stage of test development was to adapt the contents of the core construct dimensions from the facets developed for the MAS (Carcione et al. 2008, 2010; Semerari et al. 2003) and MAI (Pellecchia et al. 2015, Semerari et al. 2012) in order to reformulate the entire set of facets in terms of self-report item. This was done for each of the five dimensions (MON, DIF, INT, DEC, M). With this aim, and consistent with contemporary recommendations for test construction (Kline 1993, Clark and Watson 1995, APA 1999, Morey 2003), a test development team of five experienced therapists, with three of them authors of the MMFM, examined the universe of the original MAS and MAI items and reworded each one in a self-report form. For each item by which the wording was rising possible misunderstanding to the reader, the team developed two alternative versions. This operation led to the definition of a total of 18 items, with 8 pairs of alternative items and 10 items with no alternative wording. Items were designed to be concise, unambiguous, and minimize content overlap with the other dimensions, and be understandable by someone with a basic reading. The pool of alternative item pairs was independently reviewed by the test development team, and each one was rated for content relevance and quality using a 3-point ordinal scale, with 1 = unacceptable, 2 = fair, and 3 = good. These ratings were tallied, and items alternatives with higher ratings were retained. At the end of the items definition process the version of MSAS scale used in this study, consisted of eighteen item.

Procedures

After providing demographic information, participants completed a research questionnaire booklet including the Metacognition Self-Assessment Scale (MSAS). All data were collected anonymously and authorisations to collect the data were obtained before the study began.

Statistical analysis

Data analysis was a three steps procedure. The aim of the first step was to explore the dimensional structure of the MSAS. Since data were collected into separate phases, Sample 1 and Sample 2 were independently analysed. Sample 1 and Sample 2 were divided randomly in two equal portions. Scores from the first portion of Sample 1 and Sample 2 were independently subjected to exploratory factor analysis. Principal Component Analysis is the most widely used method of factor analysis among social scientists. It represents the optimal, in terms of least mean square error, scheme for reducing a set of variables to a small number of linearly unrelated components. Because of the algorithm on which it is based, the first axis extracted generally accounts for most of the variance and it is over-saturated. Rotation is used to mitigate this effect, Oblimin rotation was used in this study because there were correlations among the MSAS dimensions (Jackson 2003). We used the KMO test and the Bartlett's test of sphericity to assess whether the data were suitable for factor analysis, both suggested that factor analysis was appropriate: KMO was greater than 0.70 (KMO =0.92) and Bartlett's test had a significance level less than $p = 0.01$.

In the second step, we used separate confirmatory analyses of the second portion of Sample 1 and on Sample 2 to cross-validate the structure on two samples drawn from the same population. We used confirmatory factor analysis to examine a model that fitted the matrix of the 18 items of the MSAS and could be considered conceptually and theoretically plausible.

Multiple statistical fit indices were used to assess the goodness of fit of the proposed models, absolute fit indices: Chi Square/d.f. ratio and Goodness of Fit Index (GFI); relative fit indices: Comparative Fit Index

(CFI) and Non-Normed Fit Index (NNFI) and a non-centrality based index: Root Mean Square Error of Approximation (RMSEA). A model with a good fit to the data should produce consistent results on many different indices. We used recommended statistical criteria for goodness of fit (Kline 1998, Netemeyer et al. 2004, Ullman 1996): RMSEA < 0.06; CFI, NFI and NNFI > 0.90 and small Expected Cross Validation Index (ECVI) (Hu and Bentler 1999). Data analysis was carried out using Statistical Package for Social Science (IBM Corporation, Route 100 Somers, NY 10589, State of New York, United States, Version 15) and LISREL 8 (Joreskog et al. 2001).

In the last step, the four subscales of the MSAS were explored from Sample 1 and Sample 2, to provide information on the distribution of scores. Descriptive statistics for the MSAS dimensions and total score were calculated; no differences between men and women were found. The internal consistency of the scale was assessed by calculating Cronbach's alphas, average inter-item correlations (AIICs) and corrected item-total correlations (CITCs) for the sub-scores, overall MSAS score and Pearson correlations among subscales.

Results

Exploratory factor analysis

The exploratory factor analysis was conducted without imposing any restrictions on potential solutions on both samples. The screening test and the resulting eigenvalues, together with the proportions of explained variance and cumulative explained variance suggested that it would be fruitful to consider a four-factors solution. Following this, we drew on the hypothetical model of metacognitive structure to impose a four-factors solution. The results of the analysis were analogous for both samples; to facilitate the reader we reported data regarding Sample 1. Eigenvalues, proportions of explained variance and cumulative explained variance are showed in **table 1**.

In the four-factors solution each factor explained more than 5% of the unrotated variance (see **table 1**) and the whole model explained 57% of the total variance. We consider this solution to provide interesting evidence about our theoretical hypotheses about the organisation of MMFM functions. All UM monitoring and the integration items loaded on the first factor (F1: Self reflectivity); differentiation and decentration items loaded on the second factor (F2: Critical distance); all items related to Mastery functions loaded on the third factor (F3: Mastery) and UOM monitoring items loaded on the fourth factor (F4: Understanding others' mind monitoring).

The four-factors solution demonstrated that the MSAS could be considered to be composed of separate and distinct components, representing distinct metacognitive functions. Monitoring and integration of the Self constituted one factor (F1) and the other metacognitive functions - differentiation-decentring (F2), mastery (F3) and UOM monitoring (F4) – constituted other independent albeit associated factors. The pattern of correlations among the four-factors suggested that three factors (F1, F2, F4) were more associated with each other (r: 0.36 – 0.40) and the remaining factor - mastery - (F3) was weakly correlated (r: 0.26 - 0.29) with the other three factors (see **table 3**).

Confirmatory factor analysis

Confirmatory factor analysis of a four-factors model for both samples showed that the Chi Square/d.f. Ratio is consistent with a good fit (Sample 1, 14.83; Sample 2, 14.63). NNFI, NFI and CFI were for both sample above 0.90, consistent with an adequate fit as well as RMSEA (Sample 1, 0.064; Sample 2, 0.065). Parameter estimates are displayed in **table 2**.

The results were cross-validated in the two samples

Table 1. *Results from the factor analysis of the 18-item set (four-factor solution - Sample 1)*

		F1	F2	F3	F4	Communalities
1	Self MON - UMIDN1	**0.647**	-0.198	-0.021	0.010	0.555
2	Self MON - UMIDN2	**0.836**	-0.031	-0.037	-0.028	0.687
3	Self MON - UMREV1	**0.772**	-0.089	0.001	-0.058	0.627
4	Self INT - UMINT1	**0.776**	0.079	0.079	0.073	0.645
5	Self INT - UMINT2	**0.669**	0.066	0.086	0.201	0.595
6	DIF - UMDIF1	-0.041	**-0.660**	-0.002	0.005	0.417
7	DIF - UMDIF2	0.035	**-0.677**	0.038	-0.064	0.473
8	DEC - DEC1	0.040	**-0.744**	-0.040	0.096	0.610
9	DEC - DEC2	0.039	**-0.777**	-0.026	0.058	0.645
10	DEC - DEC3	0.116	**-0.630**	0.016	0.017	0.482
11	M1	0.008	0.060	**0.703**	-0.042	0.463
12	M2	0.253	0.055	**0.690**	-0.073	0.580
13	M3	0.040	-0.106	**0.693**	0.061	0.589
14	M4	-0.087	0.007	**0.657**	0.148	0.470
15	M5	-0.073	-0.388	**0.464**	-0.004	0.430
16	Other - UOMIDN1	0.129	-0.055	-0.025	**0.751**	0.667
17	Other - UOMIDN2	0.006	-0.064	-0.013	**0.839**	0.733
18	Other - UOMREV1	-0.032	0.049	0.061	**0.854**	0.723
	Eigenvalues	5.803	1.685	1.547	1.355	
	Variance (%)	32.239	9.361	8.596	7.527	
	Cumulative Variance (%)	32.239	41.600	50.195	57.722	

Note. Extraction: Oblimin Rotation. Factor loadings higher than 0.50 are marked.

Table 2. *Confirmatory factor analysis indexes of fit on both samples*

Sample	χ^2	*df.*	*RMSEA*	*ECVI*	*CFI*	*NFI*	*NNFI*
S 1	1913.66	129	0.064	6.19	0.92	0.92	0.91
S 2	1887.41	129	0.065	5.95	0.91	0.91	0.92

Note: RMSEA, Root Mean Square Error of Approximation; ECVI, Expected Cross Validation Index; CFI, Comparative Fit Index; NFI, Normed Fit Index; NNFI, Non-Normed Fit Index

and the model had adequate values on the various indices of fit, indicating that a four-dimensional latent structure could satisfactorily represent the data.

MSAS descriptive statistics and scores distribution.

Descriptive statistics for each MSAS factor, factor reliability and the correlation values among the factors for both samples are shown in **table 3**.

Cronbach's alpha ranged between 0.72 and 0.87 for all MSAS subscales and for overall metacognitive

Table 3. *Descriptive statistics, internal consistency reliability and correlations among the MSAS factors (Sample 1, n = 3459; Sample 2, n = 3200)*

SAMPLE 1	Mean	SD	Alpha	F1	F2	F3	F4
F1 - Self MON INT	4.00	0.70	0.83	—			
F2 - DIF / DEC	3.92	0.73	0.78	0.40**	—		
F3 - Mastery	3.43	0.68	0.72	0.29**	0.28**	—	
F4 - Other MON	3.26	0.79	0.80	0.36**	0.26**	0.28**	—
MSAS Global score	3.71	0.54	0.87				
SAMPLE 2	Mean	SD	Alpha	F1	F2	F3	F4
F1 - Self MON INT	4.01	0.70	0.83	—			
F2 - DIF / DEC	3.90	0.72	0.76	0.39**	—		
F3 - Mastery	3.43	0.67	0.72	0.29**	0.29**	—	
F4 - Other MON	3.23	0.80	0.80	0.37**	0.27**	0.27**	—
MSAS Global score	3.69	0.53	0.86				

Note: $^{**}p < 0.01$.

function as measured by total MSAS score, exceeding the 0.70 criterion (Clark 1995, Kline 1998, Netemeyer et al. 2004, Ullman 1996). Deleting an item did not produce a substantial increase in alpha for any of the subscales or the global scale. CITCs for all the items were substantially higher than 0.20 and AIICs of all scales ranged between 0.35 and 0.55 (Clark 1995, Kline 1998, Netemeyer et al. 2004, Ullman 1996). Pearson's correlations among the MSAS subscales were all statistically significant.

Taken together, these results are consistent with the hypothesis that the MSAS has a four-factors structure reflecting the metacognitive abilities defined in the MMFM (Carcione et al. 2008, Semerari et al. 2003); they further suggest that three of these factors relate to understanding of one's own and others' mental states.

Discussion

The aim of this study was to investigate the factorial structure of the MSAS, a self-report tool for the quick assessment of metacognitive abilities based on the MMFM which posits that metacognition has several specific, relatively independent sub-functions (Semerari et al. 2003). We tested the hypothesis that there are four different factors in the MSAS corresponding to the principal components of the MMFM. Results from exploratory and confirmatory factor analysis suggested that metacognition as measured by the MSAS is a multidimensional construct consisting of one general factor and several sub-components and suggested that Mastery is a distinct function relatively independent, or less associated, from the others. We are fairly confident that our procedure (testing first EFAs on two independent cross validation samples, and then CFAs on two independent cross validation samples) is both robust to sample error and overfitting and theoretically consistent with our anticipations and conceptual descriptions of the targeted construct .

All Monitoring and Integration items loaded on the first factor, which appeared to correspond to self-directed reflective cognition: we have named this factor *Self-Reflectivity*. As predicted Differentiation-Decentration, UOM, and M constituted different and relatively independent factors. More specifically, Differentiation-Decentration factor encompasses all the sub-functions relating to ability to distance oneself from one's thoughts: a) recognition of the representational nature of thought; b) recognition that mental representations are not objective images of external reality; c) recognition that one's own and others' beliefs may be false and d) recognition that others can have different points of view and beliefs. This factor captures ability to distance oneself from cognitions and evaluate them critically, so we named it *Critical Distance*. Items related to Monitoring Others' cognitions constituted the third factor, apparently related to ability to understand other minds: we named

this factor *Understanding Other Minds*. All the results related to these first three factors are consistent with data from the validation of the MAI (Pellecchia et al. 2015, Semerari et al. 2012). The results also supported the hypothesis that metacognitive regulation (i.e. Mastery) constitutes a separate metacognitive function, relatively independent of the metacognitive knowledge-related functions. These findings are consistent with the MMFM conceptualization of metacognition, as a general ability that emerges from the integration of semi-independent sub-functions (Semerari et al. 2003, 2007). In conclusion, this study has shown that 1) the MSAS has a good factorial validity and internal consistency in large non-clinical cross-validated samples and 2) it is consistent with an established model of metacognition (MMFM, Semerari et al. 2003, 2007). Administration of the MSAS takes approximately 10-15 minutes, and as a self-report instrument it can be used to provide a fast screening assessment of metacognitive functional abilities.

The uses of MSAS may be varied. Used formally as a self-report measure, it may act as an adjunct to the clinical interview (MAI) and it may provide valuable information for the case formulation and assessment of metacognitive abilities impairment. As showed from the factorial investigations, the MSAS seems to mainly detect self-related metacognition, considering that the first factor (Self M/I) accounts for as much variance as all the other factors put together. The MSAS can also be easily used to assess change and metacognitive improvement during treatment and at the end of it.

Limitations

In spite of the promising findings, this study has a number of limitations. It is important to note that findings based on a general population sample may not be reflected in a clinical population, where factorial structure should be replicated and clinical normative parameters have yet to be established. Regarding MSAS, further examinations of the psychometric properties of the MSAS are required; establishing the concurrent validity, test-retest reliability and predictive validity of the scale must be a priority. There is currently no evidence of convergent validity based on consistency with similar instruments and in particular, tools that measure the same functions using other methods, Reflective Function (RF) interview and questionnaire (Fonagy et al. 1997, 2016) or MCQ (Cartwright-Hatton and Wells 1997). Finally, even if the MSAS distinguishes effectively between different aspects of metacognitive abilities this does not mean that it captures general aspects of metacognitive functioning; it is for this reason that, given also the limitations inherent in particular assessment methods, we believe that research on metacognition requires the synthesis of findings based on the use of several different models and measuring instruments.

APPENDIX

Table 4. *Metacognition Self-Assessment Scale (MSAS)*

Note. For reporting the scale, English version of the MSAS was translated by two of the authors (A. C. and R. P.). The adequacy of the English version compared with the original Italian version was iteratively checked through back-translation by a professional English mother-tongue translator and by the MSAS authors.

The following questionnaire regards what people think about their ability to identify and describe their thoughts, emotions and the social relationships in which they are involved. Following the statements listed below you can indicate your judgment on what they are descriptive of yourself. Please answer to each statement marking a cross in the appropriate box. Thanks for your cooperation!

A	***RESPECT TO MYSELF, USUALLY***…	Never	Rarely	Sometimes	Frequently	Almost always
1. UM_MON_ID1	I can distinguish and differentiate my own mental abilities (e.g. remembering, imagining, having fantasies, dreaming, desiring, deciding, foreseeing and thinking).	**1**	**2**	**3**	**4**	**5**
2. UM_MON_ID 2	I can define, distinguish and name my own emotions.	**1**	**2**	**3**	**4**	**5**
3. UM_MON_RV	I am aware of what are the thoughts or emotions that lead my actions.	**1**	**2**	**3**	**4**	**5**
4. UM_DIF1	I am aware that what I think about myself is an idea and not necessarily true. I realize that my opinions may not be accurate and may change.	**1**	**2**	**3**	**4**	**5**
5. UM_DIF2	I am aware that what I wish or what I expect may not be realized and that I have a limited power to influence things.	**1**	**2**	**3**	**4**	**5**
6. UM_INT1	I can clearly perceive and describe my thoughts, emotions and relationships in which I am involved.	**1**	**2**	**3**	**4**	**5**
7. UM_INT2	I can describe the thread that binds my thoughts and my emotions even when they differ from one moment to the next.	**1**	**2**	**3**	**4**	**5**

Table 4. *Continue*

B	***RESPECT TO OTHERS, USUALLY*** …	Never	Rarely	Sometimes	Frequently	Almost always
1. UOM_MON_ID1	I can understand and distinguish the different mental activities as when they are, for example, remembering, imagining, having fantasies, dreaming, desiring, deciding, foreseeing and thinking.	**1**	**2**	**3**	**4**	**5**
2. UOM_MON_ID2	I can identify and understand the emotions of people I know.	**1**	**2**	**3**	**4**	**5**
3. UOM_MON_RV	I can describe the thread that binds thoughts and emotions of people I know, even when they differ from one moment to the next.	**1**	**2**	**3**	**4**	**5**

C	***RESPECT TO "PUT YOURSELF IN SOMEBODY SHOES", USUALLY …***	Never	Rarely	Sometimes	Frequently	Almost always
1. DEC1	I'm aware that I am not necessarily at the centre of the other's thoughts, feelings and emotions and that other's behaviours arise from reasons and goals that can be independent from my own perspective and from my own involvement in the relationship.	**1**	**2**	**3**	**4**	**5**
2. DEC2	I am aware that others may perceive facts and events in a different way from me and interpret them differently.	**1**	**2**	**3**	**4**	**5**
3. DEC3	I am aware that age and life experience can touch other's thoughts, emotions and behaviour.	**1**	**2**	**3**	**4**	**5**

D	***RESPECT TO SOLVING PROBLEMS, USUALLY*** …	Never	Rarely	Sometimes	Frequently	Almost always
1. M1	I can deal with the problem voluntarily imposing or inhibiting a behaviour on myself.	**1**	**2**	**3**	**4**	**5**
2. M2	I can deal with the problems voluntarily trying to follow my own mental order.	**1**	**2**	**3**	**4**	**5**
3. M3	I can deal with the problems trying to challenge or enrich my views and my beliefs on problems themselves.	**1**	**2**	**3**	**4**	**5**
4. M4	When problems are related to the relationship with the other people, I try to solve them on the basis of what I believe to be their mental functioning.	**1**	**2**	**3**	**4**	**5**
5. M5	I can deal with the problems, recognizing and accepting my limitations in managing myself and influencing events.	**1**	**2**	**3**	**4**	**5**

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